

## **CHAPTER 4**

### **INSTALLATION OF TWGSS**

#### **LESSON PLAN 4**

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#### **METHOD:**

Conference, demonstration and practical exercise

#### **TIME ALLOTTED:**

3.0 hours

#### **COURSE PRESENTED TO:**

- a. Tank crews
- b. Instructors
- c. TSC personnel

#### **TOOLS, EQUIPMENT AND MATERIALS (Per Tank Crew):**

- a. M1A2 tank with BII
- b. One TWGSS set
- c. TM 9-6920-709-12&P-1-2

#### **PERSONNEL:**

- a. Primary instructor
- b. Assistant instructor

#### **INSTRUCTIONAL AIDS:**

- a. Overhead projector
- b. Viewgraphs (Appendix C)

#### **REFERENCES:**

- a. TM 9-6920-709-12&P-1-2, Chapter 2
- b. TM 9-2350-288-10-1/2

#### **APPENDICES:**

Appendix A. Safety  
Appendix B. Test Administration Guide  
Appendix C. Viewgraphs

#### 4-1. INTRODUCTION.

(5 minutes)

Note. Show Slide 1.

- a. **Reason.** TWGSS is designed for quick and easy installation. To use TWGSS to its full potential, you must be able to correctly and safely install the system on the tank.

Note. Show Slide 2.

- b. **Training Objective.** Given an operational M1A2 tank with BII, and with prepare-to- fire checks, boresighting, tank preparation, and TWGSS PMCS completed, the crew will properly install TWGSS IAW TM 9-6920-709-12&P-1-2, Chapter 2.
- c. **Procedure.** During this block of instruction we will cover the installation of a TWGSS set in preparation for training. You will have an assistant (small group) instructor for the practical exercise portion of this class. After completion of training, you will be evaluated on your ability to install selected TWGSS components. You will use the appropriate TMs to install TWGSS.

#### 4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE. (155 minutes)

- Notes.
- 1. The primary instructor now releases the student crews to their assigned assistant (small group) instructor for the practical exercise portion of this lesson.
  - 2. Prior to students' arrival, ensure that an assistant instructor is assigned to each training station.
  - 3. Direct students to their appropriate training station.
  - 4. Each assistant instructor is to conduct a safety briefing for his small group IAW Appendix A.
  - 5. Whenever possible, have the student serve as demonstrators during small group instruction. Have one student read the procedures while another student performs the task. To ensure all students get equal hands-on time, rotate the reading and performance responsibilities.
  - 6. The assistant instructor discusses and clarifies the procedures as required and reinforces the training objective.

**Warning.** Ensure that main gun is locked to turret roof, turret traverse lock is engaged, GTD switch is set to MANUAL, and vehicle master power switch is in OFF position prior to installation of TWGSS. Injury to personnel or damage to components could occur.

Note. Instructor reminds students of importance of having already completed prepare-to-fire checks, boresighting, tank preparation, and TWGSS PMCS.

- a. **TWGSS Installation Tasks.** Working as a crew, you will install TWGSS on a M1A2 tank IAW TM 9-6920-709-12&P-1-2. Installation tasks include:

## **4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).**

- (1) Installation of exterior components
- (2) Installation of exterior cables
- (3) Installation of interior components and cables
- (4) Verification of installation

### **b. Installation of Exterior Components.**

#### **(1) Transceiver unit.**

- (a) Lift locking handle and insert transceiver unit into 120 mm adapter by pulling transceiver unit through rear end of adapter.
- (b) Push locking handle up to locked position.
- (c) Lower locking handle to unlocked position.
- (d) Position transceiver unit with 120 mm adapter approximately 4-6 in. into main gun with laser lens up.
- (e) Using locking handle, rotate transceiver unit and 120 mm adapter until laser lens is at 12 o'clock position.
- (f) Push locking handle up to locked position.

#### **(2) TBOS driver assembly.**

- (a) Lift locking handle on TBOS driver assembly. Open bracket.
- (b) Position TBOS driver assembly under top bracket located on gun mantle, flush with mantle, electrical connectors toward right side. Close bracket.
- (c) Push locking handle down to lock.

#### **(3) TBOS GAS assembly.**

**Caution.** Before installing TBOS GAS assembly ensure that GAS optical port is clean. Dirt and debris could damage the TBOS GAS assembly.

**Note.** The locking nut uses a 13 mm wrench found in tank BII.

- (a) Loosen TBOS GAS unit locking nut.
- (b) Position TBOS GAS unit in GAS optical port.
- (c) Tighten mounting bracket locking nut with open end wrench.

#### **(4) Retro detector assembly (right- and left-front).**

- (a) Lift locking handle.
- (b) Position retro detector assembly inside right/left upper bustle rack railing forward of sponson box.
- (c) Push locking handle down to lock.

## **4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).**

### **(5) Hull defilade detector unit (right- and left-front).**

- (a) Position unit in front of right/left tow cable brush deflector.
- (b) Ensure metal edge of unit is positioned underneath turret edge

#### Notes.

- 1. The hull defilade detector unit cable uses a push/pull type connector, not the MIL-STD connectors found on the tank.
- 2. Demonstrate to the crew how to connect and disconnect the push/pull connector.
- (c) Route and connect cable labeled J2 to retro detector unit connector J2.

### **(6) Target computer assembly.**

- (a) Lift locking handle.
- (b) Position target computer assembly on inside of right-rear bustle rack railing, with connectors toward rear of tank.
- (c) Push locking handle down to lock.

### **(7) Retro detector assembly (right- and left-rear).**

- (a) Lift locking handle.
- (b) Position retro detector assembly into right/left rear turret bustle rack upper and lower railings against outside of outermost vertical bar.
- (c) Push locking handle down to lock.

### **(8) Remote System Interface (RSI) Unit.**

- (a) Lift locking handle.
- (b) Position RSI unit on inside of left-rear bustle rack railing, with connectors toward rear of tank.
- (c) Push locking handle down to lock.

#### **c. Installation of Exterior Cables.**

### **(1) W1 cable.**

#### Notes.

- 1. Unlike tank cables, W1 cable connectors use a push/pull connector.
- 2. Demonstrate to the crew how to connect and disconnect push/pull connector.
- 3. Ensure cable dust cap does not obstruct transceiver unit field of view.

#### **4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).**

- (a) Connect cable end marked J1 to transceiver unit connector J1.
- (b) Route cable along main gun at 11 o'clock position, attach cable with Velcro straps (evenly spaced).
- (c) Connect cable end marked J2 to TBOS driver unit J2.

##### **(2) W7 cable.**

Notes.

- 1. Unlike tank cables, W7 cable connectors use a push/pull connector.
- 2. Ensure W7 cable does not interfere with TBOS GAS unit field of view.

- (a) Connect cable end marked J1 to TBOS GAS unit connector J1.
- (b) Route cable up right side of main gun. Secure with velcro straps.
- (c) Connect cable end marked J3 to TBOS driver unit connector J3.

##### **(3) W2 cable.**

Note.

Unlike tank cables, W2 cable connectors use a push/pull connector.

- (a) Connect cable end marked J1 to TBOS driver unit connector J1. Close protective bag of TBOS driver assembly.
- (b) Route cable up over turret (attach with magnets), behind GPS, to right side sponson box. Continue along box to target computer unit.
- (c) Connect cable end marked J2 to target computer unit connector J2.

##### **(4) W12 cable.**

- (a) Connect W12 cable connector J1 to target computer unit connector J1.
- (b) Route W12 cable along inside middle of bustle rack to RSI assembly.
- (c) Connect W12 cable connector J2 to RSI connector J2.

##### **(5) W5 cable.**

- (a) Connect cable end marked J3 to target computer unit connector J3.

Note.

Unlike tank cables, W5 cable connector J1 uses a push/pull type connector.

- (b) Route shorter end of W5 cable, connector J1 along turret bustle rack railing to right-rear retro detector assembly and connect to retro detector unit connector J1.
- (c) Route longer end of W5 cable, connector J1, along sponson box to right- front retro detector assembly and connect to retro detector unit connector J1.

## **4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).**

### **(6) W6 cable.**

- (a) Connect cable end marked J4 to target computer unit connector J4.

Note. Unlike tank cables, W6 cable connector J1 uses a push/pull connector.

- (b) Route shorter end of W6 cable, connector J1 along turret bustle rack railing to left-rear retro detector assembly and connect to retro detector unit connector J1.
- (c) Route longer end of W6 cable, connector J1 along sponson box to left-front retro detector assembly and connect to retro detector unit connector J1.
- (d) Close target computer unit protective bag.

### **(7) W3 cable.**

Note. Unlike tank cables, W3 cable connectors use push/pull connectors.

- (a) Connect cable end marked J1 to RSI unit connector J1. Close protective bag of RSI unit.
- (b) Route cable along inside of turret bustle rack railing to left sponson box.
- (c) Insert grommet into loader's hatch periscope mount. Secure with periscope retaining screws.
- (d) Route cable from left sponson box into grommet. Leave cable for later connection.

**Caution. Improper positioning of magnets or improper W3 cable routing can result in damage to W3 cable.**

- (e) Attach one magnet on outside of loader's hatch as close to hinge as possible.

Note. Rotate periscope in order to position cable magnets as close to hinge as possible.

- (f) Attach one magnet on inside of loader's hatch as close to hinge as possible.
- (g) Open and close hatch to ensure hatch can be operated without damage to W3 cable.
- (h) Leave other end of W3 for later connection.
- (i) Secure cables with velcro straps.

## 4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).

### d. Installation of Interior Components and Cables.

**Caution.** Do NOT use force when connecting or disconnecting cables.

#### (1) Loader's panel.

Attach loader's panel to turret support beam between ammo doors, facing loader's position.

#### (2) Vehicle interface assembly.

- (a) Position vehicle interface assembly close to .50 cal. ammo box inside tank.
- (b) Ensure all cables in vehicle interface assembly are connected.
- (c) Connect W3 cable connector J2 to TBOS video mixer unit connector J2.
- (d) Connect control panel cable connector J1 to vehicle interface unit connector J1.
- (e) Insert vehicle interface assembly into .50 cal. ammo box.
- (f) Secure vehicle interface assembly with two retaining screws.

#### (3) W10 cable.

**Warning:** Turret power switch, vehicle master power switch and turret utility power switch must be in OFF position before installing interior components and cables. Failure to follow this warning may cause turret or main gun movement, resulting in injury or death to personnel.

**Warning:** Gun must be locked to turret roof and turret traverse lock must be engaged before installing components/cables under main gun. Failure to follow this warning may result in injury or death to personnel.

- (a) Route cable bundle containing W10, W11, and W15 cables from vehicle interface assembly up turret roof support beam. Secure cable bundle to turret roof support beam with velcro straps.
- (b) Connect W10 cable connector J1 to loader's panel connector J1.
- (c) Connect W11 cable connector J2 to loader's panel connector J2.
- (d) Route cable bundle containing W10, W11, and W15 cables from turret roof support beam, over ammunition storage door at loader's position, and along left turret wall. Secure cables to existing turret cables with velcro straps.
- (e) Locate W10 cable audio input and ground cable leads. Lift audio frequency amplifier (AM1780/VRC) cover and connect audio input and ground leads to amplifier terminals. Close cover.

## **4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).**

- (f) Loosen AM1780/VRC lower right mounting nut and position ground lead under washer. Tighten nut.

**Warning:** Turret power switch, vehicle master power switch and turret utility power switch must be in OFF position before installing interior components and cables. Failure to follow this warning may cause turret or main gun movement, resulting in injury or death to personnel.

**Warning:** Gun must be locked to turret roof and turret traverse lock must be engaged before installing components/cables under main gun. Failure to follow this warning may result in injury or death to personnel.

### **(4) W15 cable.**

- (a) Locate primary data bus coupler connector J1 under turret radio rack and remove protective cover.

**Caution:** When connecting or disconnecting cables to tank use extreme care. If you have not been trained in the following task, notify your immediate supervisor for assistance.

- (b) Connect W15 cable connector J1 to digital data bus coupler connector J1.

### **(5) W11 cable.**

- (a) Remove protective cover from FCEU.

**Caution:** When connecting or disconnecting cables to tank use extreme care. If you have not been trained in the following task, notify your immediate supervisor for assistance.

- (b) Connect W11 cable connector TJ2 to FCEU connector TJ2.

**Note:** Turret cables connected to FCEU connectors J3 and J4 must be disconnected to access cable connector J12.

**Caution:** When connecting or disconnecting cables to tank use extreme care. If you have not been trained in the following task, notify your immediate supervisor for assistance.

- (c) Disconnect turret cables from FCEU connectors J3 and J4.
- (d) Remove turret cable #1W202-8/P1 from FCEU connector J12.
- (e) Connect turret cable #1W202-8/P1 to LRF node assembly connector J1.
- (f) Connect W11 cable connector J1 to LRF node assembly connector J2.
- (g) Connect LRF node assembly lead to FCEU connector J12.
- (h) Connect turret cables to FCEU connectors J3 and J4.



## **4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).**

### **(6) W14 cable.**

**Caution: When connecting or disconnecting cables to tank use extreme care. If you have not been trained in the following task, notify your immediate supervisor for assistance.**

- (a) Route cable bundle containing W8, W9, W14, and W16 cables from vehicle interface assembly, to rear of commander's seat, and along right turret wall.
- (b) Remove protective cover from alternative bus coupler connector J6 located to right-rear of TIS control panel.
- (c) Connect W14 cable connector J6 to alternate bus coupler connector J6.

### **(7) W16 cable.**

**Caution: When connecting or disconnecting cables to tank use extreme care. If you have not been trained in the following task, notify your immediate supervisor for assistance.**

- (a) Disconnect blasting machine cable #BMACH-P1 from turret cable #7W203-8/31 at cable support bracket to right of TIS control panel.
- (b) Connect W16 cable connector J1 to blasting machine cable #BMACH-P1.
- (c) Connect W16 cable connector J2 to turret cable 1W203-8/31 at cable support bracket.

### **(8) W8 cable and TIS junction box.**

**Caution: When connecting or disconnecting cables to tank use extreme care. If you have not been trained in the following task, notify your immediate supervisor for assistance.**

- (a) Disconnect TIS cable connector J2 from TIS control panel connector J2.
- (b) Connect TIS cable connector J2 to TIS junction box connector J1.
- (c) Connect W8 cable connector J3 to TIS junction box connector J3.

**Caution: When connecting or disconnecting cables to tank use extreme care. If you have not been trained in the following task, notify your immediate supervisor for assistance.**

- (d) Connect TIS junction box connector J2 to TIS control panel connector J2.

### **(9) Hoffman connections.**

**Warning: DO NOT connect Improved Tank Gunfire Simulator (Hoffman Device) unless vehicle master power switch is in OFF position and simulator safety switch is in OFF position, with key removed. Failure to follow this warning may result in injury or death to personnel.**

## **4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).**

Note: Perform the following steps only if Hoffman Device is installed on tank.

- (a) Connect W9 cable connector HOFFMAN GROUND to Hoffman Device cable connector HOFFMAN GROUND.
- (b) Connect W9 cable connector HOFFMAN POWER to Hoffman Device cable connector HOFFMAN POWER.
- (c) Connect W16 cable connector HOFFMAN TRIGGER to Hoffman Device cable connector HOFFMAN TRIGGER.

### **(10) W9 cable (power).**

**Warning: Turret power switch, vehicle master power switch and turret utility power switch must be in OFF position before installing interior components and cables. Failure to follow this warning may cause turret or main gun movement, resulting in injury or death to personnel.**

**Caution: When connecting or disconnecting cables to tank use extreme care. If you have not been trained in the following task, notify your immediate supervisor for assistance.**

- (a) Remove protective cover from digital data coupler utility jack connector UJ1.
- (b) Connect W9 cable connector UJ1 to utility jack connector UJ1.
- (c) Secure cable bundle in place with velcro straps.

### **e. Verification of Installation.**

**Warning. Ensure ALL cables between tank and TWGSS are properly connected before turning on vehicle master power switch. Improperly connected cables may cause uncontrolled gun/turret rotation causing injury or death.**

- (1) Verify that all units are properly installed.
- (2) Check that all cables are secured with velcro straps.
- (3) Check that cables are routed without loose ends and with enough slack to allow gun and turret movement.
- (4) Elevate and depress gun manually to verify that no internal or external cables or assemblies can be damaged.
- (5) Rotate turret manually to verify that no internal or external cables or assemblies can be damaged.
- (6) Check cable routing to ensure that no cables interfere with hatch operations.
- (7) Check ammo storage door to ensure that cables will not be pinched or otherwise damaged during operation of door.
- (8) Ensure all on-board equipment is stored to prevent damage to cables and assemblies.

## **4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).**

- (9) Check cable routing for potential trip hazards.
- (10) Set gun/turret drive (GTD) switch in MANUAL position.
- (11) Switch on vehicle master power.
- (12) Switch on turret power.

**Warning. If the tank FCS indicates a malfunction, immediately turn off turret and vehicle master power. Troubleshoot IAW TM 9-6920-709-12&P-1-2, Chapters 3 and 4.**

- (13) Verify that an FCS MALFUNCTION is not indicated.
- (14) Set FCS mode switch to NORMAL position.

**Warning. If uncontrolled gun/turret movement occurs, immediately release palm switch and switch off turret power and vehicle master power. Troubleshoot IAW TM 9-6920-709-12&P-1-2, Chapters 3 and 4.**

- (15) With deck of tank and area around tank clear of personnel and equipment, have gunner grasp and release palm switch to ensure that no uncontrolled gun/turret movement occurs.

## **4-3. TEST. (15 minutes/test)**

Note. See Appendix B.

## **4-4. FINAL REVIEW. (5 minutes)**

### **a. Student Questions.**

Note. Show Slide 3.

### **b. Summary of Main Teaching Points.**

- (1) Installation of exterior components
- (2) Installation of exterior cables
- (3) Installation of interior components and cables
- (4) Verification of installation

Note. Show Slide 4.

### **c. Closing Statement. This block of instruction has taught you how to properly and safely install TWGSS on an M1A2 tank.**

## **APPENDIX A TO LESSON PLAN 4**

### **INSTALLATION OF TWGSS**

#### **SAFETY**

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Listed general safety regulations are to be strictly enforced during the performance of this lesson.

1. Mount and dismount tank over left front fender.
2. Maintain three points of contact while on top of tank.
3. No smoking within 50 m of tank.
4. Do not go over or under gun tube.
5. Ensure LRF has eye-safe laser filter (ELF) installed and LRF is set to SAFE.
6. LASER SAFETY: Do not view transceiver unit with optics from a distance of 25 m or closer.
7. Ensure gun/turret drive (GTD) switch is set to MANUAL position during installation and before leaving turret.
8. Ensure vehicle master power switch is in OFF position during installation.
9. Ensure turret power switch is in OFF position during installation.
10. Ensure utility power switch is in OFF position during installation.
11. No cables should be connected or disconnected by untrained personnel.
12. Extra care should be taken when power is switched on after TWGSS installation. This is to ensure integration to FCS is correct and secure.

## APPENDIX B TO LESSON PLAN 4

### INSTALLATION OF TWGSS

#### TEST ADMINISTRATION GUIDE

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##### **B-1. TASK.**

Administer test, *Installation of TWGSS W11 Cable and LRF Node Assembly*.

##### **B-2. CONDITIONS.**

Given a fully operational M1A2 tank with TWGSS installed except for W11 cable and LRF node assembly.

##### **B-3. STANDARDS.**

The crewman will correctly install the TWGSS components within 10 minutes.

##### **B-4. PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED.**

- a. Evaluator (one per test station)
- b. TWGSS set (one per evaluator)
- c. M1A2 tank with BII (one per evaluator)
- d. TM 9-2350-288-10-1/2 (one set per test station)
- e. TM 9-6920-709-12&P-1-2 (one copy per test station)
- f. Scoring checklist of Appendix B (one copy for each crewman tested)

##### **B-5. TEST PLANNING TIME.**

Administrative time:	5 minutes
Test time:	<u>10 minutes</u>
TOTAL TIME (per crewman):	15 minutes

##### **B-6. OTHER INFORMATION.**

Before the crewman arrives, the evaluator will:

- a. Install TWGSS, except for W11 cable and LRF node assembly, IAW TM 9-6920-709-12&P-1-2, Chapter 2.
- b. Ensure FCEU protective guard is removed from underneath the gun.
- c. Have W11 cable and LRF node assembly ready for crewman to install.
- d. Ensure TM 9-2350-288-10-1/2 is available.
- e. Ensure TM 9-6920-709-12&P-1-2 is available.

- f. Have scoring checklist ready for crewman to be tested.

#### **B-7. INSTRUCTIONS TO STUDENT.**

" The purpose of this test is to determine your ability observe safety regulations and to correctly install the most critical component of TWGSS to the M1A2 tank. You will have 10 minutes to complete all steps. You must complete each step before beginning the next step. Your time will start when I announce 'BEGIN' and end when you announce 'FINISHED'. You may use TM 9-6920-709-12&P-1-2 during the test".

"Do you understand the requirements of this test?" (Answer questions)

"You may begin." (Start time)

# INSTALLATION OF TWGSS W11 CABLE

## Scoring Checklist

NAME \_\_\_\_\_ UNIT \_\_\_\_\_

GRADE \_\_\_\_\_ DUTY POSITION \_\_\_\_\_

	GO	NO GO
1. Did the soldier observe safety regulations prior to installation?	_____	_____
a. Vehicle master power switch set to OFF position	_____	_____
b. Turret power switch set to OFF position	_____	_____
c. Gun locked to turret roof	_____	_____
d. Turret traverse lock engaged	_____	_____
e. GTD switch set to MANUAL	_____	_____
2. W11 cable installation		
a. W11 cable connection to loader's panel	_____	_____
b. W11 cable routing to FCEU	_____	_____
c. W11 cable connection to FCEU TJ2	_____	_____
3. LRF node assembly installation		
a. Vehicle cable J12 removed	_____	_____
b. Vehicle cable connection to LRF node assembly	_____	_____
c. LRF node assembly cable connection to FCEU J12	_____	_____
d. W11 cable connection to LRF node assembly	_____	_____





GO

NO GO

4. Did the soldier observe safety regulations during  
installation?

\_\_\_\_\_

\_\_\_\_\_

GO

NO GO

INITIALS

Soldier satisfactorily completed all  
requirements?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

EVALUATOR \_\_\_\_\_ DATE \_\_\_\_\_

REMARKS \_\_\_\_\_

**APPENDIX C  
TO LESSON PLAN 4**

**INSTALLATION OF TWGSS**

**VIEWGRAPHS**

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